UNITED STATES PATENT OFFICE.

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CALCULATING-MACHINE.

To all whom it may concern:

Be it known that I, GEORGE B. GRANT, a citizen of the United States, residing at Maplewood, in the county of Middlesex and State 5 of Massachusetts, have invented a new and useful Improvement in Calculating-Machines, of which the following is a specification.

My invention relates to that class of calculating-machines whose object it is to perform 10 the four cardinal operations of arithmetic— addition, subtraction, multiplication, and division—and more particularly to the kind which perform the actual operation and produce the result anew at each operation, as dis- 15 tinguished from those which point out the result previously calculated by means of conveniently-arranged tables of results or logarithmic scales.

The drawings show a six-figure machine ca- 20 pable of using a number, minuend, multiplicand, or divisor of not exceeding six decimal places. Similar machines may also be made, however, according to this invention having more than six adding-rings, according to the 25 number of decimal places desired to be used.

Figure 1 is an end view with the frame removed and partly in section to show the parts more plainly. Fig. 2 is a front view. Fig. 3 shows a detail of the registering-wheels. Fig. 30 4 is a detail of the erasing apparatus, and Fig. 5 is a front view partly in section.

The two frames A A' are fastened to the base-board B, and are securely fastened together by the two parallel tie-rods C and D. 35 The two shafts E and F revolve in bearings in the frames, and are geared together by the gears e and f, so that both are revolved by the single crank F'.

The upper shaft, F, carries a long hollow 40 cylinder, G, and on this cylinder slides a carriage, H, which may be fixed in either one of six positions at equal intervals by the click h on the carriage, which will catch in either one of the six notches g on the cylinder, Fig. 5. 45 As the carriage slides along on the cylinder, it also turns partially around it, being guided by a pin, h', fixed in it, which runs in a spiral slot, g', in the cylinder. The spiral slot is made of such a pitch as to cause the carriage 50 to turn around one-twentieth of a full turn each time it is moved from one of its six posi-

tions to the next. The pin h', which guides the carriage, extends into the cylinder, and a spiral spring, f⁴, presses against it, tending to throw it forward to the left, Fig. 5. If the 55 outer end of the click h be pressed down, the click will leave the notch g and allow the carriage to move forward until the click catches in the next notch.

The carriage H carries six or more adding- 60 rings, I, mounted in annular slots, and which may be revolved on it by hand, being provided with pins or ridges i, to assist the operation. Each adding-ring is provided with ten notches, i', in its side at equal intervals of one- 65 twentieth of its circumference. A locking-bar, J, lies in a slot cut in the carriage H, and runs under all the rings. It has a locking-pin, j, at each adding-ring, a spring, j', and a knob, j². Each adding-ring may thus be fixed 70 in either one of ten different positions by drawing out the bar J by the knob, moving the ring around to the desired position, and again locking it by allowing the pin j to take into another notch. Each ring bears ten large fig- 75 ures, one at each notch, by which the ten positions of the ring are numbered, and each figure has near it a smaller or negative figure, its complement with 9.

Each adding-ring has an adding-pin, K, pro- 80 jecting from its surface, and an adding-pin, k', is fixed in the carriage beyond the last ring in the zero position, or the position it would have if it was on a ring and the ring placed in its zero position. 85

The lower shaft, E, carries six or more registering-wheels, L, (shown by the enlarged section, Fig. 3,) each revolving on a hub, l, fixed to the shaft. Each registering-wheel has twenty teeth and a flange, L', carrying two sets of fig- 90 ures, (from 1 to 10, inclusive,) running around the wheel, one at each tooth.

The sheet-steel cam-plate M, having incline m, for engaging with the hook o², is fastened to the hub l, so that the wheel L runs close to it, 95 being pressed against it by a plate friction-spring, l². The cam-plate M is larger than the wheel L, (over nine teeth,) and is cut away, so as to expose the other eleven teeth above its edge. On the side of the cam-plate there is a 100 sheet-steel lever, N, which I call a "carrier," pivoted on a pin, m'. This lever has an incline